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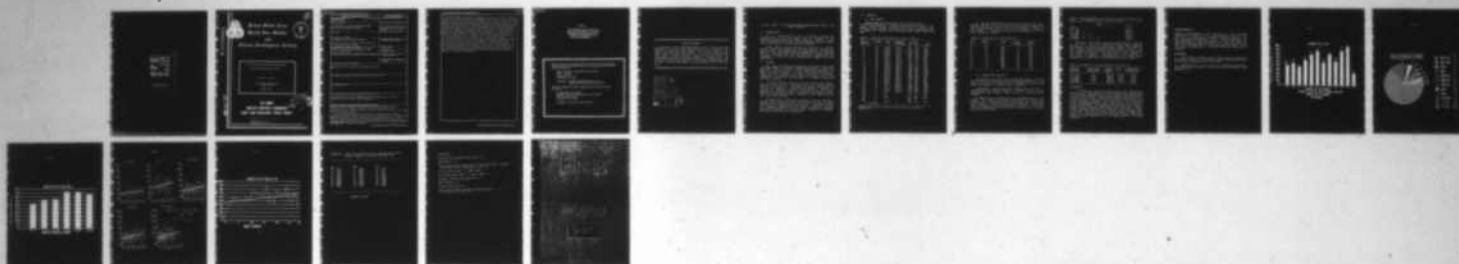
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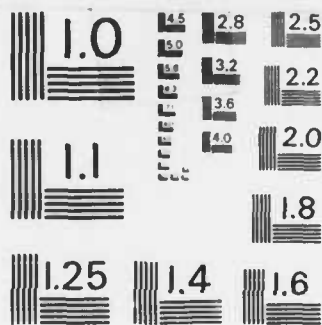
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PILOT STUDY INTO THE RELATIONSHIP BETWEEN
WORK OUT-PUT AND YEARS IN SERVICE

COL Walter A. Brusch

FINAL DENTAL CONSULTATION
REPORT #84-001

JANUARY 1984

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Time in practice and additional training have been correlated within the private sector to increases in practice income. ✓ The purpose of this investigation was to study the effect of time in service in the U.S. Army Dental Corps on treatment out-put. A correlation analysis was performed on the relationship between the independent variable of years spent in service by Army dentists to the dependent variable of daily work out-put as measured by relative dollar value. Since dental treatments at Army facilities are not based on an actual system of fees		

for services rendered a system for assigning a relative dollar value to dental procedures has been established as a management tool within the Army Dental Care system. Year group and the mean daily relative dollar value of work from three separate 10-day periods were obtained from 348 dental officers assigned to nine Dental Activities distributed throughout the eastern and southern United States. A significant positive relation was found between years in service and work out-put. The value of the correlation coefficient r was 0.267 for the 29 year period which exceeded the significant value for Pearson's r (0.254 at $P=0.01$, 100df) (2). Significance testing was also performed using the New Multiple Range Test Duncan Procedure. No significant differences were found between the <1-3 year group and the 4-6 year group. The 7-10 year group produced significantly more than the <1-3 year group. The greatest increases were seen in both the 11-15 year and 16-20 year groups which produced significantly more than either the <1-3, 4-6, and 7-10 year groups. Additional correlation analysis was performed on intervals of 0-6, 0-11, 0-15, 0-20 and 0-29 years to detect possible differences in strength of correlation. The strength of the relationship between years in service and work out-put tended to increase in each interval up to 20 years and tended to decrease after that period which suggests a curvilinear relationship.

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EXECUTIVE SUMMARY

A correlation analysis was performed on data from 348 dentists assigned to nine U.S. Army Dental Activities to determine the nature of the relationship between years of active duty in the Dental Corps and daily work out-put. This analysis demonstrated that there is a significant increase in daily work out-put as time within the Corps increases. However, the strength of the relationship varies and may demonstrate a curvilinear rather than strictly a linear relationship. The greatest increases occur up to the 11th year and remain relatively constant until the 20th year.

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A PILOT STUDY INTO THE RELATIONSHIP BETWEEN WORK OUT-PUT AND YEARS IN SERVICE

I. INTRODUCTION:

This is the second pilot study on possible relationships between work out-put and time in service requested by the Assistant Surgeon General for Dental Services. Both this study and the pervious one are part of the FY84 Dental Study Program, "Time Utilization in the Army Dental Care System."

Since previous data indicated that there was an apparent strong correlation between the first six years in service and work out-put, the second study was commissioned to investigate whether this association could be detected for a longer interval of time. A larger sample size from different installations was requested to obtain a more representative sample from the population.

II. METHODS:

Data was collected from nine Dental Activities distributed throughout CONUS. In general, DENTACs were selected if they were monitoring the work out-put of their professional personnel by means of "relative dollars." If their values included 30 or more days, and were recorded to provide a system of personnel evaluation, the DENTAC dollar estimate of work out-put was accepted and keyed into the data base. Five Dental Activities met this criteria.

Four other DENTACs located in proximity to Fort Sam Houston, Texas provided raw daily treatment logs to the Dental Studies Division for analysis. The sampling procedure consisted of taking the average of three, 10-day samples to provide an estimate of individual doctor work out-put for the data base. Background information on year of graduation from dental school, years in the Army Dental Corps, speciality skill identifier, and rank was also included.

Variables that affect work out-put, such as additional duties and extent of auxilliary support were included initially, however, this information was not provided in a consistent manner and could not be considered in the analysis. Data was analyzed on a Maguson computer using the SPSS-X statistical package. Additional analysis and graphics were produced on Columbia, Osborne and Radio Shack microcomputers.

III. RESULTS:

A. DATA SUMMARY.

Nine DENTACs provided data on daily work out-put on 348 dental personnel. The data is summarized in TABLE 1. The years in service ranged from less than one year to 29 years; the measure of work out-put, relative dollar value, ranged from \$103 to \$2336, the average daily value over the 29 year period was \$584.

TABLE 1: Descriptive Statistics by Years in Service

YEARS IN SERVICE	NUMBER	MEAN \$	STANDARD DEVIATION	\$ VALUE MAX	MIN	RANGE
<1	12	275.4	137.3	569	103	466
>1	27	365.9	114.4	602	248	354
2	32	579.5	370.7	(1) 2336	204	2132
3	37	550.8	216.4	1251	207	1044
4	25	583.9	169.1	881	320	561
5	17	499.1	160.2	919	264	655
6	24	528.1	171.8	903	127	776
7	18	493.6	149.4	743	172	571
8	21	594.0	239.8	1170	172	998
9	10	506.0	213.1	783	161	622
10	10	645.5	334.2	1285	149	1136
11	14	770.9	283.5	1152	252	900
12	12	682.2	331.7	1571	402	1169
13	8	705.3	393.9	1309	241	1068
14	7	626.9	182.9	865	319	546
15	9	647.9	364.1	1346	246	1100
16	4	887.3	184.1	1065	653	412
17	5	446.2	247.5	770	181	589
18	15	689.1	199.1	1127	451	676
19	3	408.3	315.0	737	109	628
20	11	810.1	354.8	1561	373	1188
21	5	717.6	408.9	1339	248	1091
22	7	630	453.9	1632	306	1326
23	4	708.8	334.8	1121	352	769
24	4	871.7	600.3	1670	313	1357
25	-	-	-	-	-	-
26	2	368	-	467	269	198
27	2	697	-	805	589	216
28	1	-	-	642	-	-
29	2	282.5	-	346	219	127
(T = 348)						

*Daily work out-put values for this subject are listed in Appendix A.

Of the 348 observations on work out-out 221 were from 63-A General Dentistry Officers and 127 were from dental specialists. The relative dollar value for the various specialties ranged from \$313 for oral pathologists to \$991 for oral surgeons. (TABLE 2 and FIGURE 1) The relative proportions from each SSI in the study is shown in FIGURE 2.

TABLE 2: SPECIALTY SKILL IDENTIFIER DATA

SSI 63-	NUMBER	MEAN \$	TYPICAL YR GROUP	TYPICAL RANK
A	221	523	4	CPT
B	36	559	16	LTC
C	2	468	16	COL
D	17	639	17	COL
E	12	791	14	LTC
F	12	880	15	LTC
G	13	583	20	COL
H	1	805	27	COL
K	12	614	13	LTC
M	8	888	13	LTC
N	11	991	15	LTC
P	2	313	13	LTC

B. CORRELATION ANALYSIS.

A significant correlation was found between years in service and work out-put. The value of the correlation coefficient r was 0.267 for the 29 year period which exceeded the significant value for Pearson's r (0.254 at $P=0.01$, 100df) (2).

Significance testing was also performed using the *New Multiple Range Test* Duncan Procedure. (TABLE 3) For this test observations were entered into six years of service groups. (FIGURE 3)

No significant differences were found between groups 1 and 2 however both groups 3 and 6 were significantly different from groups 1 and 2 and groups 4 and 5 were significantly different from groups 1, 2 and 3. This test of statistical significance bears out what may be seen graphically in figure 3: that work out-put increases up to the 11-15 year intervals and plateaus out during 16-20 years.

TABLE 3: DUNCAN PROCEDURE (For testing differences between group means. The "*" denotes significant differences.)

		GROUP						MEANS
		1	2	3	4	5	6	
GROUP								
0-3 YRS	1							468.27
4-6 YRS	2							544.94
7-10 YRS	3	*						557.14
21-30YRS	6	*						653.96
16-20YRS	5	*	*	*				694.66
11-15YRS	4	*	*	*				697.28

Additional correlation analysis was performed on intervals of 0-6, 0-11, 0-15, 0-20 and 0-29 years to detect possible differences in strength of correlation. (TABLE 4 and FIGURE 4) The strength of the relationship between years in service and work out-put tended to increase in each interval up to 20 years and tended to decrease after that period which suggests a *curvilinear relationship*. The possibility of non-linearity is also shown in FIGURE 5 which shows both the least square regression line and a plot of average work out-put by years.

TABLE 4: Correlation and Linear Regression Statistics

INTERVAL GROUP (No.)	X (YEAR GROUP) MEAN (Years)	Y (WORK) MEAN (\$)	SLOPE	R CORRELATION COEFFICIENT
0-6 (174)	3.24	523.41	20.09	0.145
0-11 (247)	4.83	520.84	16.68	0.239
0-15 (283)	6.09	556.81	18.9	0.293
0-20 (321)	7.59	578.65	15.92	0.323
0-29 (348)	8.81	584.06	11.00	0.267

DISCUSSION:

A correlation analysis was performed on 348 observations from nine U.S. Army Dental Activities to determine the nature of the relationship between years of active duty in the Dental Corps and daily work out-put. This analysis demonstrated that there is a significant increase in daily work out-put as time within the Corps increases. However, the strength of the relationship varies and may demonstrate a curvilinear rather than strictly a linear relationship. The greatest increases occur up to the 11th year and remain relatively constant until the 20th year. These results are quite logical when viewed within the context of other career variables that affect work out-put. During the early part of a career, the officer is less productive due to inexperience. Later, he is more productive but has yet to receive additional training. After training and for an extended period, he is most productive.

ACKNOWLEDGEMENTS:

Special acknowledgement must be given to the following individuals for their efforts in completing this study: To LTC King for his assistance in producing computer graphics that facilitated data presentation; To Dr. A. David Mangelsdorff for his assistance in the data analysis; To SSG R.A. Lamb who helped to keep the project on track; To Mrs. Cookie Gonzalez, Mr. R.J. Plaia and SSG Lamb for extracting relative dollar values from daily treatment logs. A job which took over 500 hours to complete.

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2. Burrington, R.S., and D.C. May, Jr.: Handbook of Probability and statistics with tables, 2nd ed., New York, McGraw-Hill Book Company, 1970.

FIGURE 1

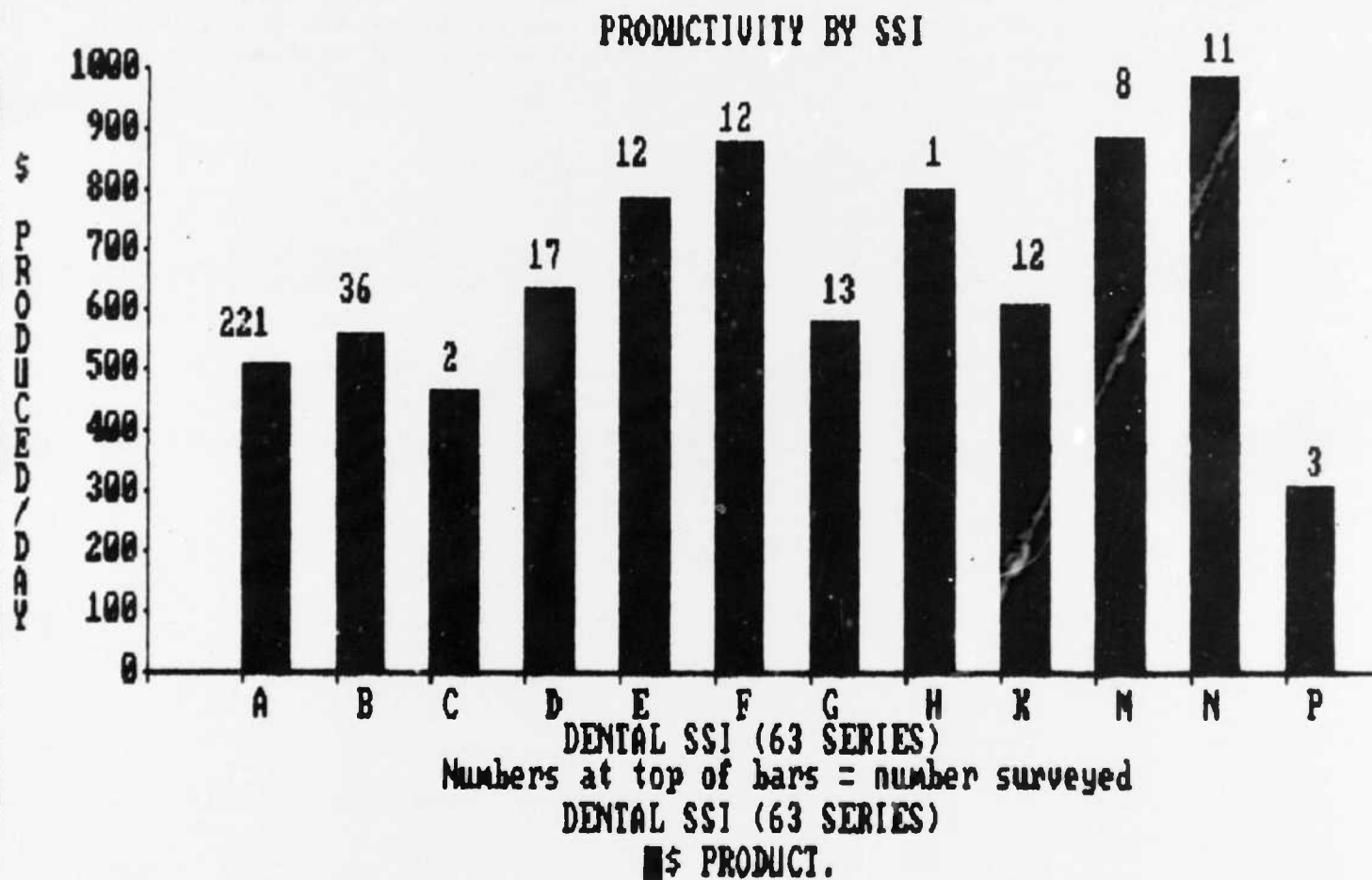


FIGURE 2

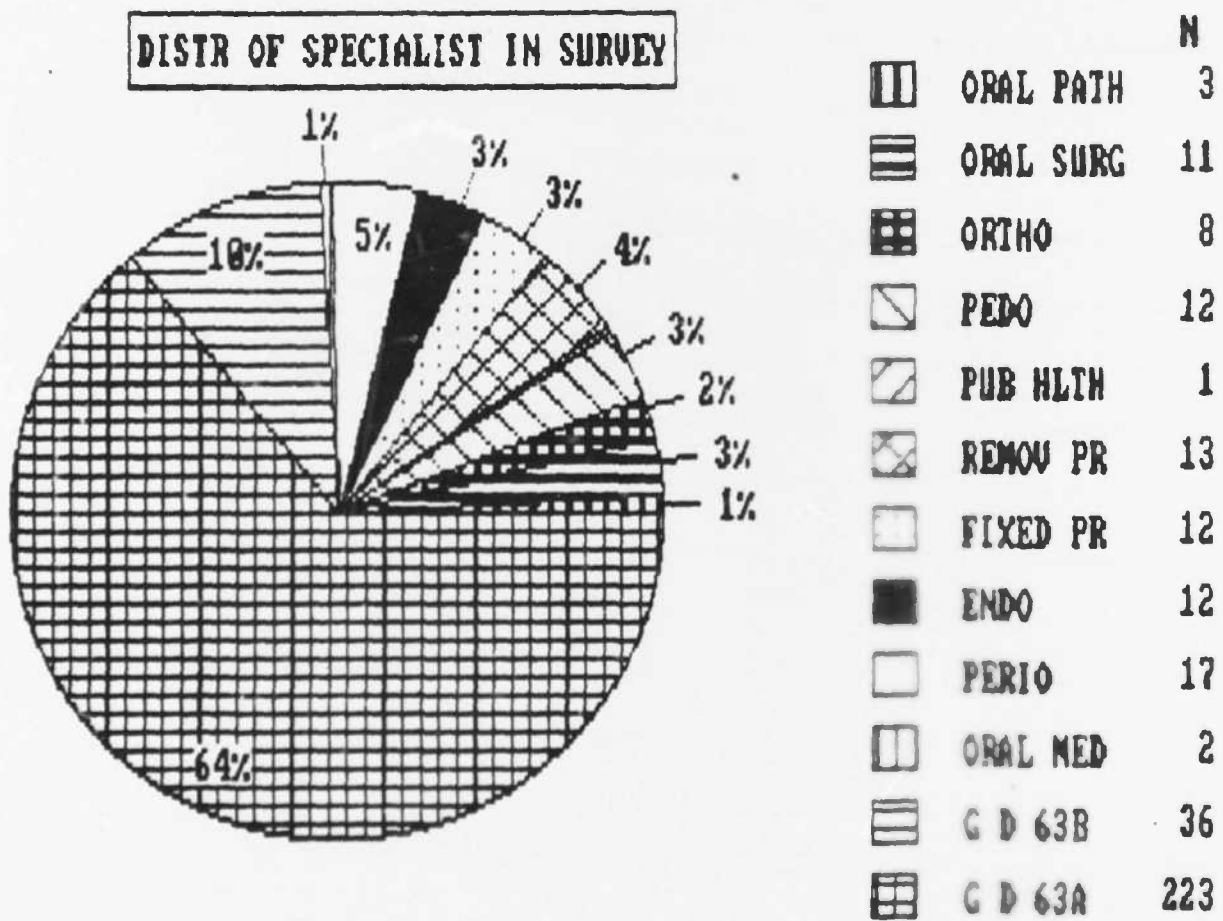


FIGURE 3

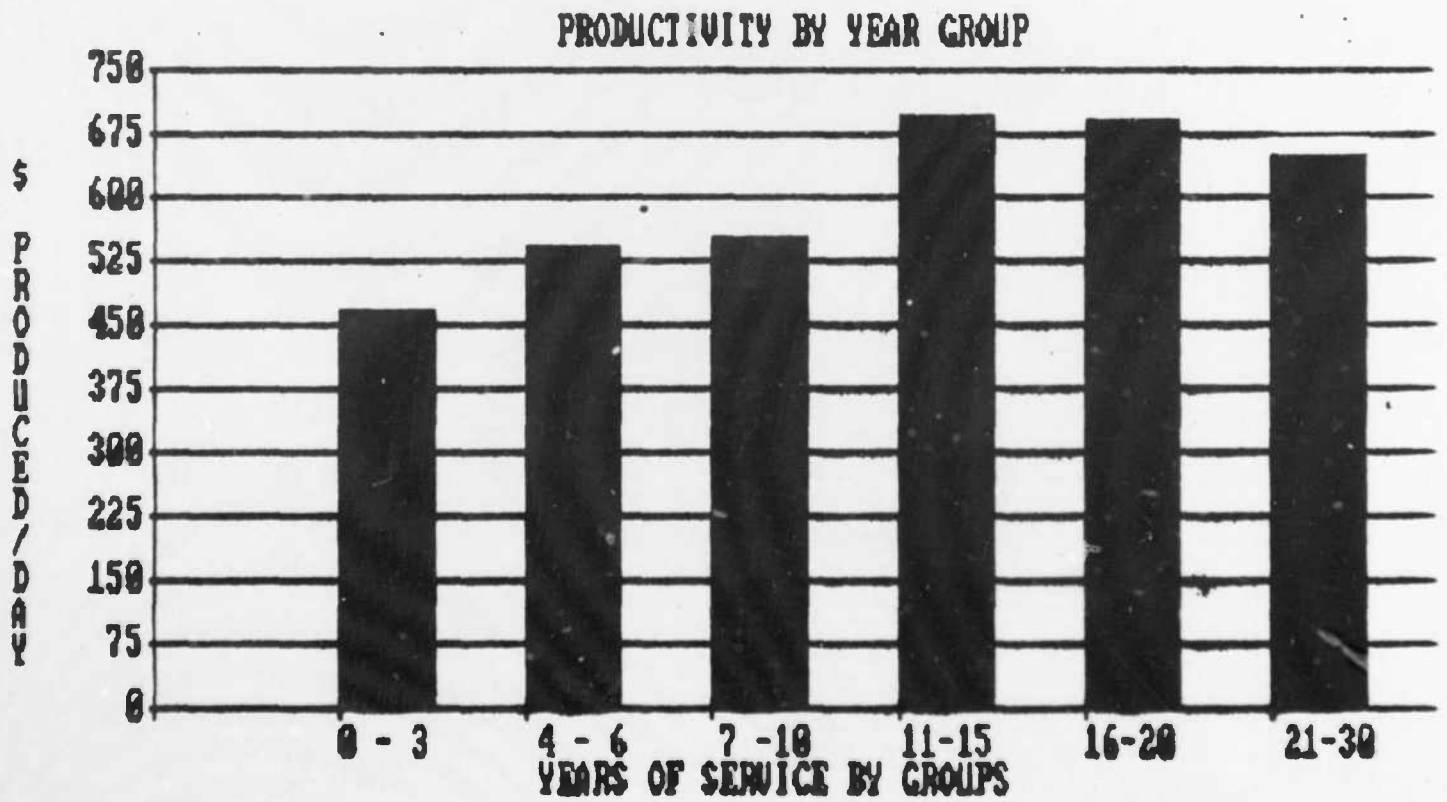


FIGURE 4

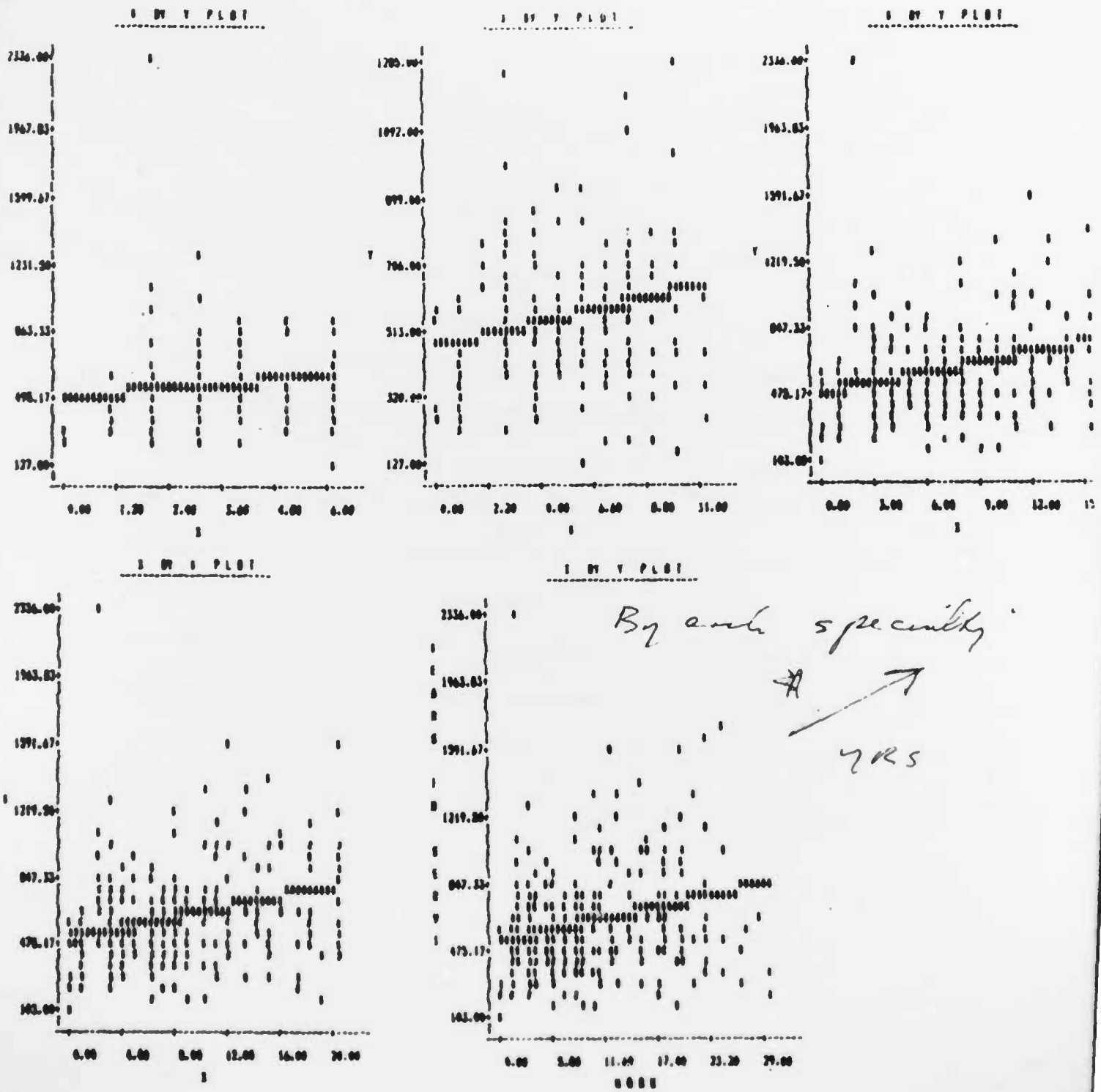
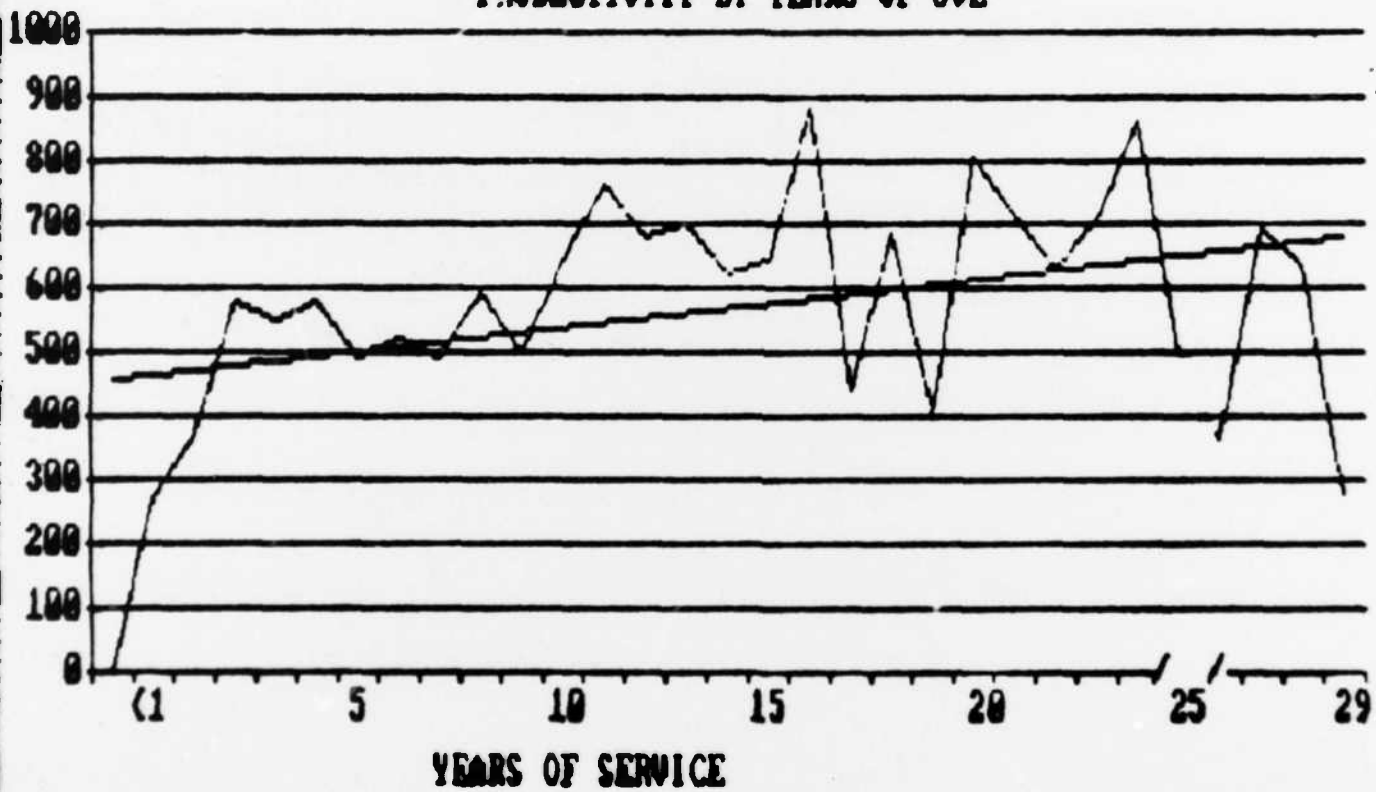


FIGURE 5

PRODUCTIVITY BY YEARS OF SUE



APPENDIX A: Daily work values for three 10-day periods on the
subject reported as producing \$2336 per day.

JAN		APR		JUL	
10	1023	4	1627	11	2466
11	1703	5	2998	12	3141
12	1516	6	2404	13	3627
13	1790	7	3069	14	2372
14	1865	8	2749	15	3532
17	1180	11	1749	18	2482
18	1816	12	3211	19	2253
19	2888	13	1838	20	2979
20	2412	14	2831	21	2658
21	1282	15	2027	22	2597

AVERAGE = \$2,336

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